IRES 2015 Poster Exhibition
9th International Renewable Energy Storage Conference
WCRE
EUROSOLAR The European Association for Renewable Energy

Proposals for a new Electricity Market Model

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Introduction

The electricity sector holds an important role in an energy system based on renewable energies especially given its close connection with the heat and mobility sectors. If the power generation is based on fluctuating energy sources, such as solar and wind, the energy system has to be adjusted to it. An adequate power supply network could compensate regional and, via a cross-sectoral load management, even temporal differences between power provision and consumption to a certain extent.
Storage systems must compensate for the remaining positive residual load. Especially the implementation of long-term storage is challenging, since relevant technologies are new (and therefore expensive), and their application depends on market demands. To date, long-term storage is not utilized, yet, primarily due to the more affordable storage of conventional primary energies.

Basic Idea

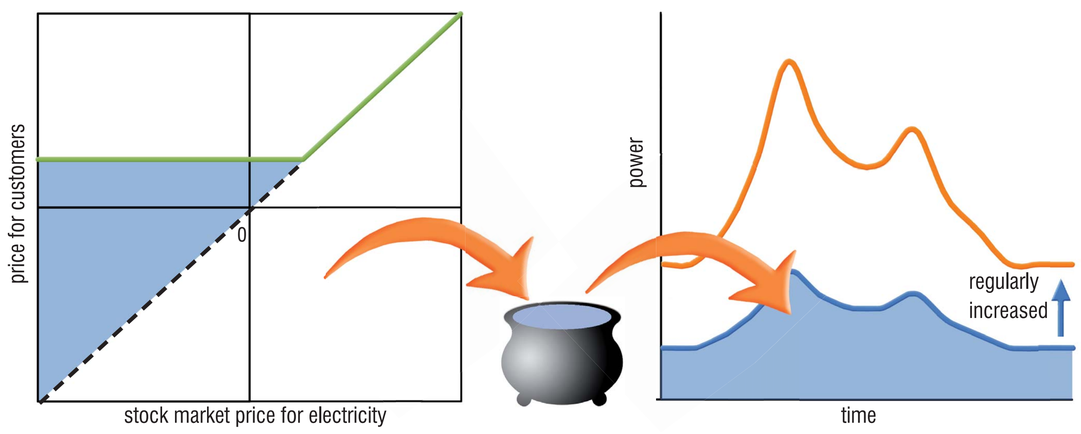
In the following, a multi-component electricity market model is proposed which is designed to accelerate the implementation of storage systems via adequate mechanisms, support load management, and promote the interaction of the three energy sectors. Low electricity prices serve as indicator for a large supply of renewable energies. Money is raised via a base price for electricity. The early confirmation of the ability to provide power from renewable energy sources over a specific period of time will be reimbursed with this money. The implementation of long-term storage systems will be supported this way. Since this model reveals many aspects it is also conceivable to implement just parts of it.

Funding Options

The model proposes three funding choices, from which each consumer may choose only one option.

Standard Model

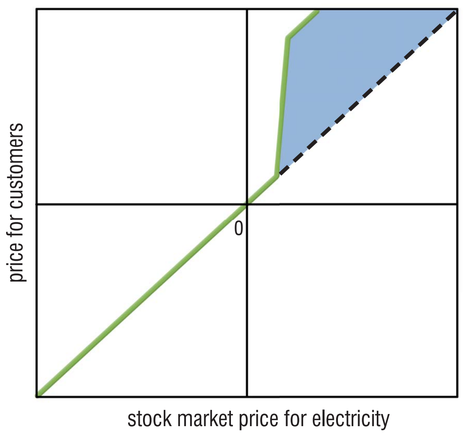
The first option assumes a base price for electricity at which most consumers are charged, when it differs from the stock market price. The surplus will be saved for financing the promised provision of power (cf. Reimbursement: Standard Model). The effects on the consumers include less varying prices for electricity.



Standard model: Base price has to be payed at low stock market prices (green line). Revenues serve as reimbursement for the early promised provision of energy (blue area). Reimbursed power (blue line) depends on the forecasted demand (orange line)

Valley Filling

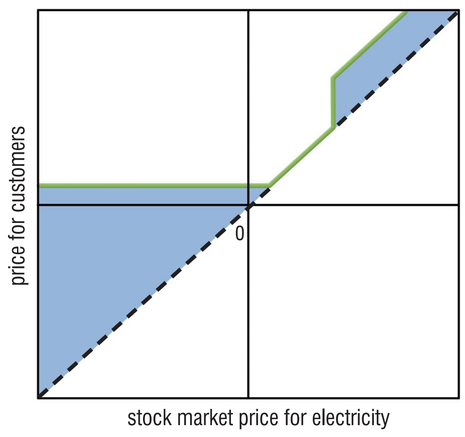
“Valley Filling“ is a suitable choice for consumers who purchase electricity only at low prices. These consumers do not rely on storage systems and thus should not have the burden of financing them. Additional high charges are incurred if the stock market price is high to prevent the usage of stored energy. Target consumers for this funding option include storage operators, Power-to-Heat and other flexible facilities.



Model: „Valley Filling“

Load Shifting

“Load Shifting” is the third funding choice and a type of load management. Compared to the standard option, the incentive to buy electricity when the supply is high is intensified. The base price is lower in this method than in the standard option, yet an additional moderate fee is charged at high stock market prices.
Consumers with a high self-production of electricity from renewable energies could be obligated to use this option in a modified form since they benefit from storage systems while avoiding the base price.



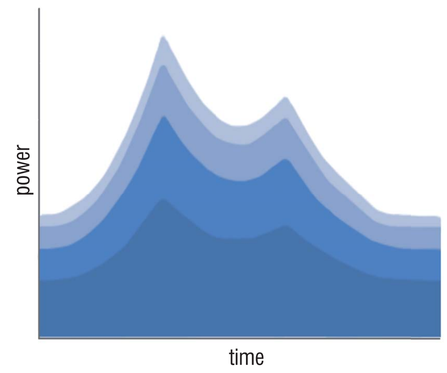
Model: „Load Shifting“

Reimbursement

On the basis of forecasted demand three reimbursement models are proposed. The Standard Model can be complemented by Timing and Regional Structure aspects.

Standard Model

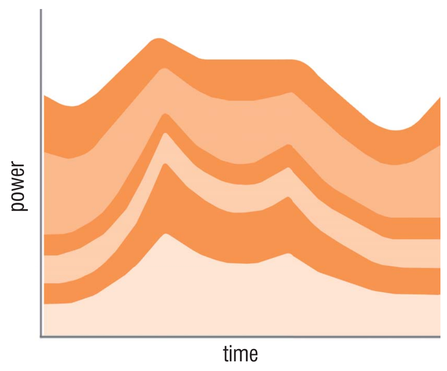
A constant sum of money is contracted for the early promised provision of a certain amount of energy from renewable sources over a specified period of time. That way, the development of storage systems and the promotion of electricity from steady sources like bio-gas, hydro-electric power plants and geothermal energy will be supported.
Operators have to share the total sum when the promised provision exceeds the reimbursed demand for a set duration of time. Thereby, an incentive is created to provide power over another period of time.



Timing: Promising provision of energy early is better reimbursed (presented in dark colour)

Timing

Long-term storage systems are indispensable and other types of storage may diminish their return on investment; however, it should be noted that lower capacity storage systems also have unique advantages so that their market participation should be supported.
Yet, overall, long-term storage takes top priority and is supported by gradually reimbursing more money per unit, which provides an incentive for the supplier to promise his provision of power as early as possible.



Regional Structure: Reimbursement depends on region (bright areas). Except for this, place of location is irrelevant (dark areas)

Regional Structure

It could be reasonable to link the reimbursement to a certain area. In administration units of low hierarchy level (i.e. regions) a lower percentage of the consumption should be reimbursed than in administration units of high hierarchy level (i.e. federal states).

Conclusion

This model provides a framework for an energy system based on renewable energy sources which is also productive for the transition to this state. Hence, it guarantees planning reliability. The primary goals include secured provision of electricity from renewable energy sources while ensuring sufficient storage systems. This will be implemented through incentive-based programs and in combination with load management. The model provides components which allow for the frequent adjustments needed due to growing experience, and to meet the constantly changing demands of the energy system. At the same time, it can be combined with other instruments like parts from the Renewable Energy Act.

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